Note on the occurrence of Callionymidae at the coast of Estoril (Portugal)

by

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RÉSUMÉ. - Note sur la présence de Callionymidae sur la côte de l'Estoril (Portugal).

Des prélèvements, réalisés au chalut à perche le long de la côte de l'Estoril (à l'ouest de Lisbonne), ont permis la capture de quatre espèces de Callionymidae. *Callionymus lyra* Linnaeus, 1758, a été l'espèce la plus abondamment capturée. Celle-ci présente une préférence pour les zones les moins profondes et les plus abritées de la côte. *C. reticulatus* Valenciennes, 1837 a été capturé principalement près de la côte sur des fonds peu profonds. Au contraire, *C. maculatus* Rafinesque-Schmaltz, 1810 a été plus abondant dans les zones les plus profondes, situées à l'ouest de cette région. Enfin, *C. risso* Lesueur, 1814 a été l'espèce la plus rare avec seulement 18 spécimens capturés. La côte de l'Estoril est probablement la limite nord de la distribution de cette espèce. Une revue des captures de Callionymidae dans les environnements côtiers du Portugal est présentée et commentée.

Key words. - Callionymidae - ANE - Portugal - Distribution.

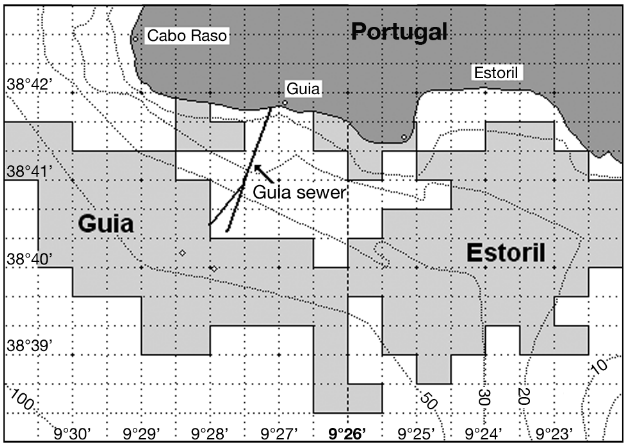

Figure 1. - Sampling area in light-grey. Depth in meters.

The Portuguese coastal ichthyofauna includes four species of the genus *Callionymus*, i.e., *Callionymus lyra* Linnaeus, 1758, which is by far the most common species (Tab. I), and three other species reported from coastal environments: *C. maculatus* Rafinesque-Schmaltz, 1810, *C. reticulatus* Valenciennes, 1837 and *C. risso* Lesueur, 1814. In beam trawl samples caught on the coast of Estoril (Fig. 1) between 2007 and 2010, specimens of all four species were obtained in the same coastal region (approximately 9 x 12 km). The fish abundance was mapped according to a latitude/longitude grid (Fig. 2).

MATERIAL AND METHODS

Samples were caught with a 3 m beam trawl. Location and duration of trawls depended on the presence and position of the fishing gear used by local fishermen. Frequently, the trawl became entangled with fishing traps, and the sampling had to be terminated before the intended duration was reached (20 min). The trawl positions were monitored using a portable GPS. The boat position was recorded at 5 min intervals. The distances travelled were calculated considering that one minute longitude corresponded, approximately, to 1444 m and one minute latitude to 1841 m. The fish abundances were calculated as the number of fish per 1000 m^2. It was impossible to establish sampling stations in a traditional way, due to the high densities of commercial fish traps present in the area, so that the trawls were

Table I. - Captures of *Callionymus* spp. in percentage by numbers. C: coast; E: estuary; L: lagoon; X: species present, percentage unknown.

Ecosystem	Type	Reference	*C. lyra*	*C. maculatus*	*C. reticulatus*	*C. risso*
Ria de Aveiro	L	Rebelo (1992)	100			
Aveiro	C	Castro (2008)	99	< 1		
Mondego	E	Jorge (1991)	100			
Figueira da Foz	C	L. Cunha and Antunes (1993)	100			
Óbidos	L	Gordo and Cabral (2001)		100		
Berlengas	C	Almeida (1996)		100		
Estoril	C	This paper	86	11	3	< 1
Tagus	E	Costa (1980)	100			
		Thiel *et al*. (2003)		100		
Fonte da Telha	C	Cabral *et al*. (2000)	X	X	X	
Albufeira	L	L. Cunha and Antunes (1991)	28			72
Arrábida	C	Henriques *et al*. (1999)	X		X	
Sado	E	Sobral (1981)	100			
		L. Cunha and Peneda (1985)	89			11
		L. Cunha (1994)	95		< 1	5
		Cabral (1999)	96	2	2	
Mira	E	Almeida (1988)	100			
Arade	E	Gonçalves *et al*. (2006)	X	X	X	X
Ria Formosa	L	Monteiro (1989)	100			
		Ribeiro *et al*. (2006)		X		X

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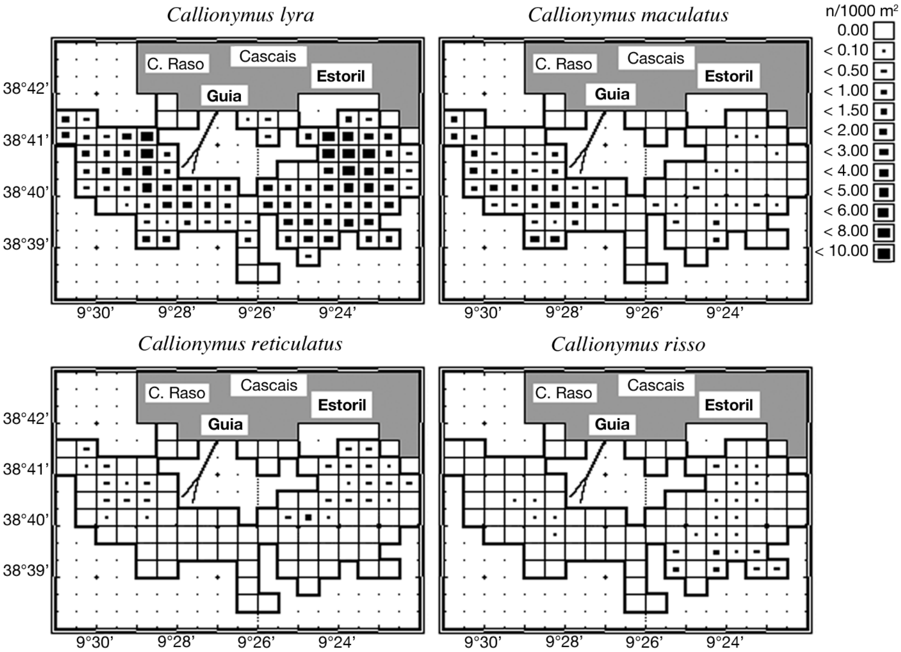

Figure 2. - Spatial variation of captures of *Callionymus* spp., with a beam trawl at the coast of Estoril between 2007 and 2010.

more or less randomly distributed. To account for this random sampling, the spatial distributions of the species were studied in relation to a latitude-longitude grid. The study area was divided in rectangles of 0.33 min of latitude by 0.5 min of longitude (Fig. 1). The rectangles such defined were approximately measuring 613 x 722 m. For each sample the distance travelled was calculated. The abundance of each species for each (sampling) rectangle was calculated as the weighted average of all samples that passed through that particular (sampling) rectangle. A distribution map is presented for each species (Fig. 2). The frequency of occurrence (f) was also calculated, as the number of samples with species "s" divided by the total number of samples. A first approach to the data obtained leads to the division of the study area in two sub-areas that were defined in relation to the meridian 9º26' W. An occurrence west of this meridian is here named "Guia", an occurrence east is named "Estoril" (Fig. 1).

In the laboratory the fish were identified, sexed, weighed, and measured to the nearest mm (total length).

Species identification followed Fricke (1986) and nomenclature, Fricke (2002) and Eschmeyer and Fricke (2011).

A broad examination of literature related to Portuguese coastal ichthyofauna was made to gather information on recent captures of Callionymidae allowing the comparison of species distributions. When information was available the relative abundance of Callionymidae species was calculated (Tab. I). Ecosystems were classified as coastal (6), estuary (5) or lagoon (4). This classification was based on the degree of confinement and fresh water input. The distinction between estuaries and lagoons is sometimes dubious, because of the torrential regime of some Portuguese rivers. In fact some estuaries have, for the much part of the year, lagoon characteristics (v.g. Sado estuary).

RESULTS

Studied area

Samples were taken along the coast of Estoril, which has an East-West orientation (Fig. 1) and is subject to the influence of the hydrodynamics of Tagus estuary. The coastline is mostly rocky, with silt in the east (Estoril) and deeper sand and gravel bottoms in the west (Guia). The presence of the Guia sewage pipe (Fig. 1) contributes to the organic nutrification of the sediment; however, the strong swell, characteristic of winter storms, prevents the accumulation of fine sediments in the area (Neves *et al*., 2002).

Captures

The most abundant species was, by far, *Callionymus lyra*, which averaged 25.9% of the total number of fish caught at Estoril and 12.7% at Guia (Tab. II). The abundance is even higher by weight reaching a maximum of 53.8% in Estoril (2010).

There was a significant difference between the spatial distributions of *C. reticulatus* and *C. maculatus* as the former was more common at Estoril and the latter at Guia (Tab. II, Fig. 2). It could be also noticed that captures of *C. maculatus* suffered a decline between 2007 and 2010. This species was present in more then half the samples at Guia (f > 0.5) during 2007 and 2008. Not a single specimen was caught in 2010, neither at Guia nor at Estoril.

C. risso was clearly the least common species as only 18 specimens were caught. This species corresponded to less than 0.1% of the fish caught both by numbers and by weight (Tab. II).

DISCUSSION

According to Fricke (1986), the European ichthyofauna includes 9 species of Callionymidae belonging to three genera. In the examined literature, only 4 species are referred for the Portuguese coast, however Fricke (1986, 2002) includes this region in the range of *Callionymus pusillus* Delaroche, 1809 and *Synchiropus phaeton* (Günther, 1861). As this last species occurs at depths of 80-650 m (Fricke, 1986) its capture in coastal samples was not expectable.

The presence of species of the family Callionymidae along the Portuguese coast was reported in 23 papers (including this one) referring to 15 different environments (Tab. I). *Callionymus lyra*

Table II. - Beam trawl captures of *Callionymus* spp. in Estoril coast.

Species	Zone	Year	n/1000 m^2	%	g/1000 m^2	%	f
C. lyra	Guia	2007	2.0	11.7	89.9	22.0	0.679
		2008	3.9	15.5	184.8	27.6	0.852
		2009	3.6	11.2	182.2	14.3	0.913
		2010	3.5	17.7	215.4	32.7	1.000
	Estoril	2007	6.6	29.3	260.2	52.4	0.950
		2008	5.9	26.0	272.8	46.3	0.964
		2009	7.2	23.4	377.0	34.0	0.971
		2010	6.9	32.5	272.5	53.8	1.000
C. maculatus	Guia	2007	2.0	11.7	9.2	2.2	0.571
		2008	0.9	3.7	2.8	0.4	0.519
		2009	0.7	2.2	1.4	0.1	0.217
		2010	0				
	Estoril	2007	0.04	0.2	0.1	0.01	0.150
		2008	0.04	0.2	0.1	0.01	0.107
		2009	0.03	0.1	0.1	0.01	0.029
		2010	0				
C. reticulatus	Guia	2007	0.01	0.1	0.01	0.01	0.036
		2008	0.10	0.4	0.27	0.04	0.037
		2009	0.04	0.1	0.11	0.01	0.087
		2010	0.08	0.4	0.28	0.04	0.125
	Estoril	2007	0.31	1.4	0.96	0.2	0.250
		2008	0.16	0.7	0.56	0.1	0.143
		2009	0.30	1.0	1.63	0.1	0.257
		2010	0				
C. risso	Guia	2007	0.04	0.2	0.08	0.02	0.107
		2008	0.01	0.1	0.02	0.002	0.037
		2009	0				
		2010	0				
	Estoril	2007	0.04	0.2	0.06	0.01	0.100
		2008	0.09	0.4	0.18	0.03	0.214
		2009	0.02	0.1	0.05	0.004	0.057
		2010	0.04	0.2	0.05	0.01	0.091

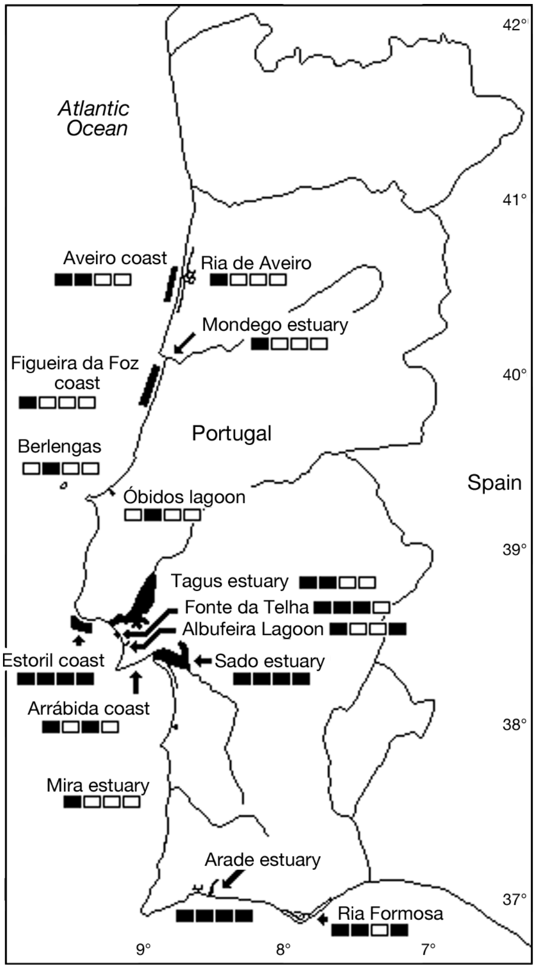

Figure 3 - Location of reported captures of *Callionymus* spp. on Portuguese coast. Black rectangles indicate the presence of the various species, from left to right: *Callionymus lyra*, *C. maculatus*, *C. reticulatus* and *C. risso*. See references in table I.

was the most widely distributed species and was only absent in the Berlengas archipelago and Óbidos lagoon (Fig. 3, Tab. I). The data for this species indicate that it is adaptable to more or less confined environments albeit showing a certain preference for sandy substrate (Almeida, 1988; Henriques *et al*., 1999; Ribeiro *et al*., 2006). Samples made in Sado estuary showed very high abundances near the Setúbal's sewage dump (Lopes da Cunha, 1994), where fine sediment and organic nutrification were evident. The second most common species was *C. maculates,* which was caught in seven ecosystems, three coastal, two lagoons and two estuaries (Tab. I). The other species, *C. reticulatus* and *C. risso*, were present in five ecosystems and none was found north of the coast of Estoril. The literature data (Tab. I) indicate that *C. risso* prefers sheltered environments (lagoons and estuaries) and it's presence on Estoril coast was the only coastal occurrence. On the contrary, *C. reticulatus* was never caught in lagoons and the presence of this species in Sado estuary is only related to the capture of six specimens in the vicinity of the estuary mouth (Lopes da Cunha, 1994) and other five referred by Cabral (1999). This species was reported to be common at the coast of Arrábida (Henriques *et al*., 1999) just outside Sado estuary (Fig. 3).

The collection data and the literature show that the occurrence of the family Callionymidae is related to the different ecological characteristics in each species. Our data indicates that *C. maculatus* prefers deeper bottoms then *C. reticulatus*. Both species seem to avoid very confined environments, namely lagoons. On the contrary *C. risso* occurs mainly in shallow environments, namely estuaries and lagoons. At the Portuguese coast *Callionymus lyra* was clearly the most abundant species, only surpassed by *C. risso* in Albufeira Lagoon (Tab. I). This last species is the only that do not reach north Europe (Fricke, 1986), with its northern limit somewhere along the coast of Portugal. Our data suggest that Estoril could be that distribution limit.

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